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Notes on the predation of an assassin bug by a spider in a Neotropical cave

Leopoldo Ferreira de Oliveira Bernardi[1], Vinícius da Fontoura Sperandei[2], Lívia Dorneles Audino[3], Carlos Henrique Sena[4], Jessica Aline Alves[5]

1 *Departamento de Entomologia, Programa de Pós-Graduação em Entomologia, Lavras, Minas Gerais, Brazil* **2** *Programa de Pós Graduação em Ecologia, Universidade Federal de São João Del Rei, São João Del Rei, Minas Gerais, Brazil* **3** *Biodata Consultoria Ambiental, Lavras, Minas Gerais, Brazil* **4** *Biocenose Consultoria Ambiental, Sete Lagoas Minas Gerais, Brazil* **5** *Empresa ILCOM mineração e comércio, Sete Lagoas, Minas Gerais, Brazil*

Corresponding author: *Leopoldo Ferreira de Oliveira Bernardi* (leopoldobernardi@gmail.com)

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Abstract

Intraguild predation have rarely been documented in scientific literature, even though this type of interaction can affect population dynamics and competition. In this study we present an intraguild predation event that occurred at different times, but in the same cave, where we observed spiders of the species *Enoploctenus cyclotorax* preying on specimens of assassin bug *Zelurus diasi*. Inside the studied caves, food resources are scarce and populations can be fairly small in size. It is possible, therefore, that these events are the result of ecological pressures imposed by the hypogean environment.

Keywords

Brazil, intraguild, invertebrates, *Zelurus*, *Enoploctenus*

The study of ecological interactions is essential to understand how subterranean communities are assembled, however, few studies addressing this theme have been conducted so far. In the Neotropical region, research that aimed to elucidate the relationships among cave species are even scarcer and little is known about how such interactions can influence the communities present in the hypogean environment (Ferreira and Martins 1999; Bernardi et al. 2010; Souza-Silva and Ferreira 2014; Resende and Bichuette 2016; Vasconcelos et al. 2017). Even more unusual are reports about intraguild predation interactions (Souza-Silva and Ferreira 2014; Resende and Bichuette

2016). Although rare, this type of interaction is potentially important, since it may decrease competition between apex predators, affecting population dynamics more strongly than the commonly observed predation and competition interactions (Polis et al. 1989; Finke and Denno 2006; Moeller et al. 2019). Thus, in this study, we report the occurrence of intraguild predation events involving a spider species (Araneae: Ctenidae: *Enoploctenus cyclotorax*) (Bertkau 1880) and an assassin bug species (Hemiptera: Reduviidae: *Zelurus diasi*) (Costa Lima 1940) (Figure 1), in a limestone cave located in the Sete Lagoas municipality, Minas Gerais state, Brazil (Figure 2).

We observed the intraguild predation events during a cave fauna monitoring project involving 26 caves near a mining area. We have been monitoring those caves since 2016, visiting each cave seasonally. Six visits have been made so far (September 2016, January 2017, January and June 2018 and May 2019). During data collection, we have sampled the distributions of cave species larger than 1 cm, counting these species through visual sense and spatial plotting individuals on the cave map. The time we spent on the monitoring varied for each cave. Because every cave environment is different and unique, the necessary sampling time may increase or decrease. However, the average sampling time was 12 minutes per 10 m^2 per cave. The team was always composed by three biologists with experience in cave fauna collection, as recommended by Weinstein and Slaney (1995).

The studied caves are in the area of the Cerrado biome, but in a very anthropized region. The caves are located in a small patch of vegetation, surrounded by planted pastures. The karst relief where the caves are located is part of the Bambuí Group, which consists of gray limestone interspersed with marble and slate. The climate is Humid subtropical climate (Cwa) (Peel et al. 2007) with an annual average tempera-

Figure 1. Adult specimens of *Zelurus diasi* (left) and *Enoploctenus cyclotorax* (right) observed in the study area.

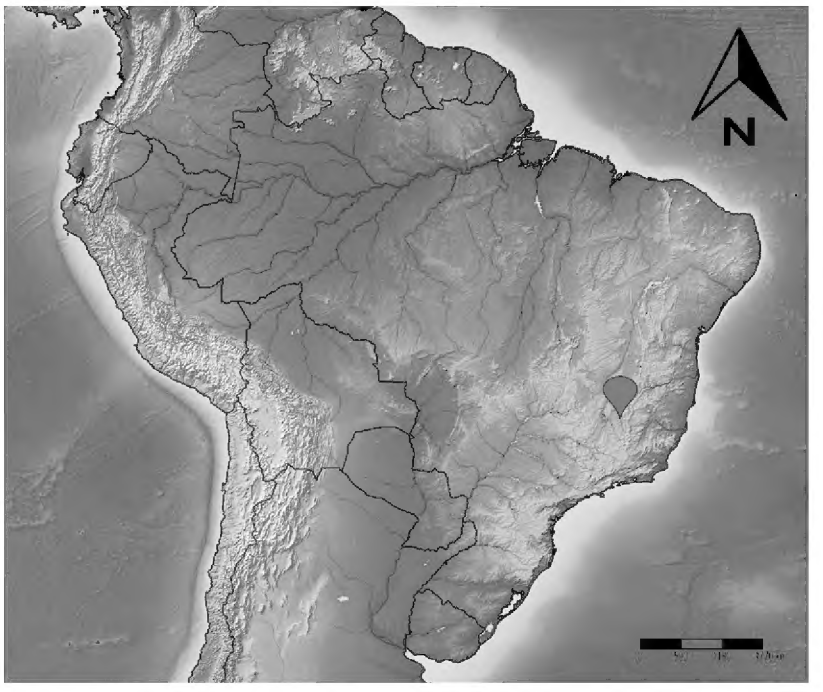

Figure 2. Location of the cave where we observed the intraguild predation events in Sete Lagoas, Minas Gerais, Brazil.

ture of 21.5 °C and the distribution of average rainfall throughout the year for the region is 1328.7 mm, but marked by a conspicuous annual variation (drought and rainy periods) (INMET 2019).

We observed the intraguild predation in one of the studied caves (WGS84 – 19°29'45"S, 44°13'12"W). This cave presents a small underground space with a horizontal projection of 5.2m, volume of 2.2 m^3 and area of 5.3 m^2. The access to the underground is a small entrance. The main portion of the cave is composed of a single passage that presents a strongly ascending floor, towards the end of the cave. Despite the relatively small size, it is possible to distinguish two zonations inside the cave: (*i*) entrance, which is photic and (*ii*) middle/distal portion, which is dysphotic. The entrance of the cave is located approximately one meter above the epigeal floor. Such morphology combined with the cave slope make it difficult for organic matter to enter from the epigean to the hypogean environment. The main organic resource observed inside the cave is mid-sized mammal feces.

We observed intraguild predation events at two different times. The first record was during the dry season, in September 2016, when a female of *Enoploctenus cyclotorax* was spotted preying on an adult *Zelurus diasi* (we could not identify the sex because the specimen had the abdomen smashed, probably by the spider). We observed the second eventin January 2017, during the rainy season. In this occasion we found an adult female spider *E. cyclotorax* preying upon a juvenile *Z. diasi* (Figure 3).

Zelurus and *Enoploctenus* are voracious predators with a wide distribution in caves and epigean environment of Brazilian territory (Pinto-da-Rocha 1995; Pellegatti-Franco 2004; Ferreira et al. 2016). Both species have a similar diet, eating a wide variety of invertebrates, such as crickets, cockroaches, scorpions, beetles, velvet worms, wasps, harvestmen and pseudoscorpions (Pellegatti-Franco 2004; Willemart and Pellegatti-Franco 2006; Fischer et al. 2006; Franco 2006; Franco and Monge-Nájera 2016; Grossi et al. 2012; Lira et al. 2016; Stevenson and Stohlgren 2015; Westcott et al. 2016). Intraguild predation is a potentially dangerous strategy, because the prey (in this case, *Z. diasi*) is also a predator,

Figure 3. Intraguild predation between female *Enoploctenus cyclotorax* and adult *Zelurus diasi* observed during the study.

armed and capable of killing. In addition, some Reduviidae produce a repulsive substance that may deter other predators (Evangelin et al. 2014). However, in the cave environment, the ability to catch and feed on other predators may be an advantageous behavior, since caves are notoriously known for their scarcity of food resources (Poulson and White 1969, Simon et al. 2007). The studied cave is known by its food scarcity and low density of potential prey for the *Zelurus* and *Enoploctenus* species, with only a few large-sized invertebrate species observed during the monitoring. During the study, we noticed that the cave where the events of intraguild predation occurred had a reduced number of prey. In this cave, we sampled only two other invertebrate species that could be potential prey for *Enoploctenus* and *Zelurus*.

Furthermore, these potential prey species have a body size compatible with other prey used by these species on previous studies. The potential prey are Lepidoptera from the genus *Hypena* (Noctuidae), which had an observed abundance ranging from 0 to 3 adult individuals. Although juvenile Lepidoptera from this genus are also potential prey of *Zelurus*, they were observed, but not accounted for the study. We also observed a small number of individuals of *Endecous* crickets (Phalangopsidae) (zero to one adult) during the visits to the cave. The *E. cyclotorax* spiders had their abundance ranging between 0 and 2 specimens during the monitoring, and *Z. diasi* was the only species observed in all six visits, showing an abundance of 4 to 8 individuals during the monitoring. The other species observed in the cave were spiders (*Mesabolivar* sp., *Plato* sp. and *Isoctenus* sp.), ants (*Solenopsis* sp.), booklice (not identified) and mites (*Erythracarus* sp.). We considered those invertebrate species as potential preys to *Zelurus* and *Enoploctenus*, because we have previously observed these invertebrates' species being preyed by *Zelurus* and *Enoploctenus* in other caves of the same area.

It is noteworthy mentioning that *Zelurus* is apparently not a frequent prey for spider species. Thus, it may be that they use specimens of this group as a resource only in very specific situations. In the study conducted by Pellegatti-Franco (2004) regarding the feeding behavior of *Ctenus fasciatus*, several species were offered as prey to this spider. Some of them, such as crickets, cockroaches, small vertebrates and even other spiders were accepted and used as a resource. However, species of the genus *Zelurus* were not preyed by *C. fasciatus* spiders.

Even though intraguild predation may be a rare phenomenon, it can be beneficial for predators, for example decreasing competition for prey (Polis et al. 1989). In caves where resource and prey are scarce, this may be an important factor, maintaining the species in that challenging environment. In conclusion, we suggest that unfavourable circustances may have led the spiders to prey upon an unconventional type of prey.

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